

What is claimed is:

1. A microelectromechanical system (MEMS) device comprising:  
5                   a first wafer;  
  
                  a second wafer; and  
  
                  a third wafer, wherein  
  
                  at least a portion of the second wafer is movably connected between  
  
the first wafer and the third wafer; and  
  
10                  material bonding the first wafer, the second wafer, and the third wafer  
  
together.
  
2. The MEMS device of claim 1, further comprising:  
  
15                  an internal cavity formed between the first wafer and third wafer,  
  
wherein the at least a portion of the second wafer is located within the internal  
  
cavity.
  
3. The MEMS device of claim 2, further comprising:  
  
20                  a seal formed from the material bonding the first wafer, the second  
  
wafer, and the third wafer together, wherein the seal seals the internal cavity.
  
4. The MEMS device of claim 3, further comprising:  
  
25                  a vacuum in the internal cavity, wherein the seal seals the vacuum in  
  
the internal cavity.

5. The MEMS device of claim 3, further comprising:

a dielectric in the internal cavity, wherein the seal seals the dielectric in the internal cavity.

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6. The MEMS device of claim 3, wherein the seal comprises a hermetic seal operable to substantially prevent moisture from entering the internal cavity.

7. The MEMS device of claim 1, further comprising:

10 a chip including the first wafer, the second wafer, and the third wafer bonded together.

8. The MEMS device of claim 7, wherein the first wafer is a cap protecting the second wafer and the third wafer in the chip.

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9. The MEMS device of claim 1, further comprising:

at least one via in the second wafer, the at least one via providing a path for electrical signals traveling through the second wafer.

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10. The MEMS device of claim 9, wherein the at least one via comprises a conductor extending through the second wafer.

11. The MEMS device of claim 9, wherein a thickness of the second wafer is approximately equal to 300 microns or less.

12. The MEMS device of claim 9, further comprising:

a first circuit; and

a second circuit, wherein the first circuit and the second circuit are in  
5 electrical communication with each other by transmitting the electrical signals  
using the at least one via.

13. The MEMS device of claim 12, wherein the first circuit is on the first wafer  
and the second circuit is on the third wafer.

14. The MEMS device of claim 12, wherein the first circuit comprises active or  
passive components on one of an upper surface and a lower surface of the  
second wafer, and the second circuit is on one of the first wafer and the third  
wafer.

15. The MEMS device of claim 9, further comprising:

a first circuit including components on at least one of the first wafer  
and the third wafer and also including components on the second wafer;

wherein at least one of the components on the first wafer or the third  
20 wafer and at least one of the components on the second wafer are in electrical  
communication with each other by transmitting the electrical signals using the  
at least one via.

16. The MEMS device of claim 15, wherein the first circuit comprises mover electronics operable to control a movement of the at least a portion of the second wafer in a MEMS storage device.

5 17. The MEMS device of claim 16, further comprising:

a read/write mechanism on the first wafer;

a read/write mechanism electronics on at least the first wafer; and

a storage media on the second wafer opposite the read/write mechanism; wherein

10 the read/write mechanism electronics is operable to control the read/write mechanism to read, write or access bits from the storage media.

18. The MEMS device of claim 17, wherein the read/write mechanism comprises at least one of field emitter tips, optical emitters, and micro-cantilevers.

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19. The MEMS device of claim 17, wherein:

the read/write mechanism electronics comprises emitter electronics at least on the first wafer;

20 the read/write mechanism comprises emitter tips on the first wafer; and the emitter electronics is operable to control the emitter tips to read, write or access bits from the storage media.

20. The MEMS device of claim 17, wherein the mover electronics includes components on the third wafer that communicate through the at least one via

to the read/write mechanism electronics to invoke reading, writing, or  
accessing bits from the storage media.

5 21. The MEMS device of claim 15, wherein the first circuit comprises transducer  
electronics and electrodes comprising capacitive plates, wherein at least one of  
the electrodes is on the at least a portion of the second wafer; the transducer  
electronics being operable to detect movement of the at least a portion of the  
second wafer by detecting a change in capacitance between the capacitive  
plates.

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22. The MEMS device of claim 21, wherein the transducer electronics is operable  
to detect movement in one or more of the x, y, and z directions.

15 23. A MEMS device comprising:  
a chip including three wafers connected together in a stacked  
arrangement; the stacked arrangement comprising:  
a first wafer of the three wafers;  
a second wafer of the three wafers connected below the first wafer in  
the stacked arrangement, the second wafer including a movable portion; and  
20 a third wafer of the three wafers connected below the second wafer in  
the stacked arrangement, wherein the three wafers are connected using a  
bonding material; and  
at least one via in the second wafer operable to pass electrical signals  
through the second wafer.

24. The MEMS device of claim 23, further comprising at least one circuit including components on at least two of the three wafers, wherein the components are in electrical communication by passing signals through the at least one via.
25. The MEMS device of claim 24, further comprising a capacitive transducer operable to detect movement of the moveable portion of the second wafer.
26. The MEMS device of claim 25, further comprising:  
a dielectric in an internal cavity formed between the first and third wafers; and  
the at least one circuit comprises opposing electrodes forming a capacitor.
27. The MEMS device of claim 24, further comprising a MEMS storage device operable to store bits in a storage media on one of the three wafers.
28. The MEMS device of claim 27, wherein the at least one circuit comprises:  
mover electronics operable to invoke read/write mechanism electronics to control a read/write mechanism to read, write or access bits from the storage media.
29. The MEMS device of claim 28, wherein the read/write mechanism comprises at least one of field tip emitters, optical emitters, and micro-cantilevers.

30. The MEMS device of claim 28, wherein the mover electronics are operable to move the movable portion of the second wafer to read, write, or access bits from a different locations on the storage media.

5 31. A three-wafer MEMS chip comprising:  
mechanical means for moving in response to one of an external force and a force generated internal to the chip, the mechanical means being a portion of a second wafer located between a first wafer and a second wafer;  
bonding means for bonding the first wafer, the second wafer and the  
10 third wafer to form a single chip; and  
via means for conducting electrical signals through the second wafer.

32. The three-wafer MEMS chip of claim 31, further comprising:  
an internal cavity means formed between the first wafer and third  
15 wafer, the internal cavity means for enclosing one or more of a dielectric and a vacuum.

33. The three-wafer MEMS chip of claim 32, wherein the bonding means further comprises means for sealing the internal cavity wafer.

20 34. The three-wafer MEMS chip of claim 31, further comprising:  
a first circuit means including components on at least one of the first wafer and the third wafer and also including components on the second wafer;

wherein at least one of the components on the first wafer or the third wafer and at least one of the components on the second wafer are in electrical communication with each other by transmitting the electrical signals using the via means.

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35. The three-wafer MEMS chip of claim 34, wherein the first circuit means comprises means for at least one of (1) invoking movement of the mechanical means, (2) reading or writing data to a storage means, and (3) detecting movement of the mechanical means.

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36. A MEMS data storage device comprising:
- a first wafer;
  - a second wafer;
  - a third wafer, wherein at least a portion of the second wafer is movably
- connected between the first wafer and the third wafer;
- material bonding the first wafer, the second wafer, and the third wafer;
  - a storage media storing data; and
  - at least one circuit associated with performing data operations using the storage media.

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37. The MEMS data storage device of claim 36, wherein the bonding material bonds the first wafer, the second wafer, and the third wafer forming a single chip MEMS data storage device.



38. The MEMS data storage device of claim 36, further comprising:

at least one via in the second wafer, the at least one via providing a path for electrical signals traveling through the second wafer.

5 39. The MEMS data storage device of claim 38, wherein the at least one circuit comprises:

components on at least one of the first wafer and the third wafer and also including components on the second wafer;

10 wherein at least one of the components on the first wafer or the third wafer and at least one of the components on the second wafer are in electrical communication with each other by transmitting the electrical signals using the at least one via.

15 40. The MEMS data storage device of claim 39, wherein the at least one circuit comprises mover electronics operable to control a movement of the at least a portion of the second wafer in the MEMS data storage device.

41. The MEMS data storage device of claim 40, further comprising:

a read/write mechanism on the first wafer;

20 a read/write mechanism electronics included in the at least one circuit,

the read/write mechanism electronics located on at least the first wafer; and

the storage media located on the second wafer opposite the read/write mechanism; wherein

the read/write mechanism electronics is operable to control the read/write mechanism to read, write or access bits from the storage media.

42. The MEMS data storage device of claim 41, wherein the read/write mechanism comprises at least one of field emitter tips, optical emitters, and micro-cantilevers.

43. The MEMS data storage device of claim 41, wherein:

the read/write mechanism electronics comprises emitter electronics at least on the first wafer; and

the read/write mechanism comprises emitter tips on the first wafer; and the emitter electronics is operable to control the emitter tips to read, write or access bits from the storage media.

44. The MEMS data storage device of claim 40, wherein the mover electronics includes components on the third wafer that communicate through the at least one via to the read/write mechanism electronics to invoke reading, writing, or accessing bits from the storage media.

45. The MEMS data storage device of claim 36, further comprising:

an internal cavity formed between the first wafer and third wafer, wherein the at least a portion of the second wafer is located within the internal cavity.

46. The MEMS data storage device of claim 45, further comprising a vacuum enclosed in the internal cavity by the material.
47. A MEMS transducer device comprising:
- 5                   a first wafer;
- a second wafer;
- a third wafer, wherein at least a portion of the second wafer is movably connected between the first wafer and the third wafer;
- material bonding the first wafer, the second wafer, and the third wafer;
- 10                  and
- at least one circuit operable to detect movement of the at least a portion of the second wafer.
48. The MEMS transducer of claim 47, wherein the at least one circuit is operable
- 15                  to detect movement in one or more of x, y, and z directions.
49. The MEMS transducer of claim 48, wherein the movement is in response to an external force.
- 20                  50. The MEMS transducer of claim 47, wherein the bonding material bonds the first wafer, the second wafer, and the third wafer forming a single chip MEMS transducer device.
51. The MEMS transducer of claim 47, further comprising:

at least one via in the second wafer, the at least one via providing a path for electrical signals traveling through the second wafer.

52. The MEMS transducer of claim 51, wherein the at least one circuit comprises:

5 components on at least one of the first wafer and the third wafer and also including components on the second wafer;

wherein at least one of the components on the first wafer or the third wafer and at least one of the components on the second wafer are in electrical communication with each other by transmitting the electrical signals using the at least one via.

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53. The MEMS transducer of claim 52, wherein some of the components of one or more of the first, second and third wafers comprise electrodes forming capacitive plates on at least two of the first wafer, the second wafer, and the third wafer, the at least one circuit detecting a change in capacitance between the capacitive plates to detect movement of the at least a portion of the second wafer.

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54. The MEMS transducer of claim 52, further comprising:

20 a dielectric sealed between the capacitive plates by the material.

55. The MEMS transducer of claim 53, wherein the first wafer is a protective cap.